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(54) **ALLOCATION OF SERVICE PROVIDER RESOURCES BASED ON A CAPACITY TO PROVIDE THE SERVICE**

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**G06Q 10/06** (2012.01)

(52) **U.S. Cl.**

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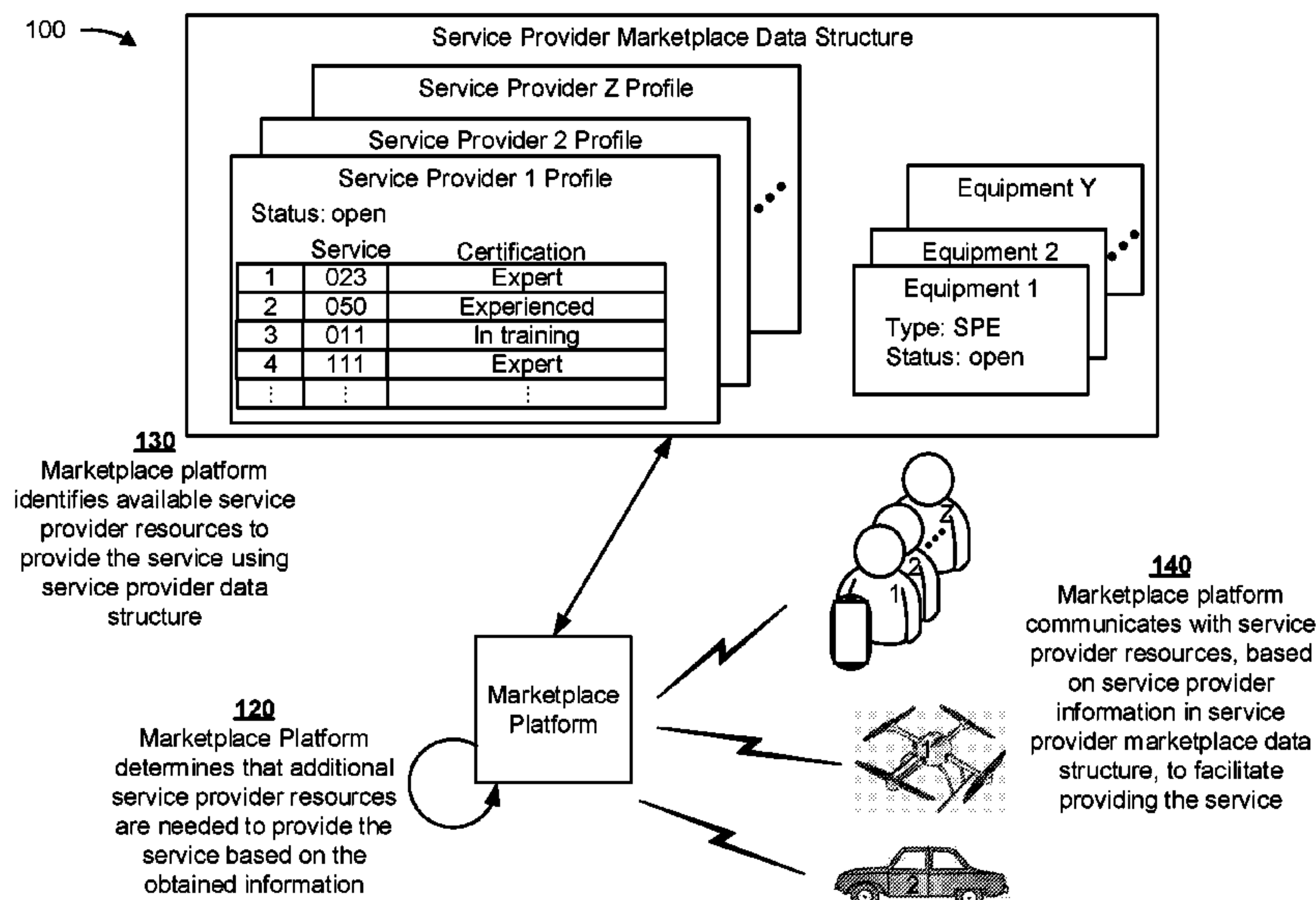
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(57) **ABSTRACT**

An example includes one or more devices may include one or more memories and one or more processors, communicatively coupled with at least one of the one or more memories, to identify a service that is provided within a region; identify a model that is associated with the service, the model having been trained based on consumer profile data, service provider data, and historical information; determine a current demand associated with the service in the region; predict, using the model and based on the current demand associated with the service, a future demand for the service during a time period; determine a current capacity to provide the service based on real-time service provider information associated with service providers that are providing the service in the region; and perform an action associated with the service based on the future demand for the service and the current capacity to provide the service.

**20 Claims, 6 Drawing Sheets**



(52) **U.S. Cl.**  
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 (2013.01); *G06Q 10/0631* (2013.01); *G06Q*  
*10/06315* (2013.01)

(58) **Field of Classification Search**  
 USPC ..... 705/7.31  
 See application file for complete search history.

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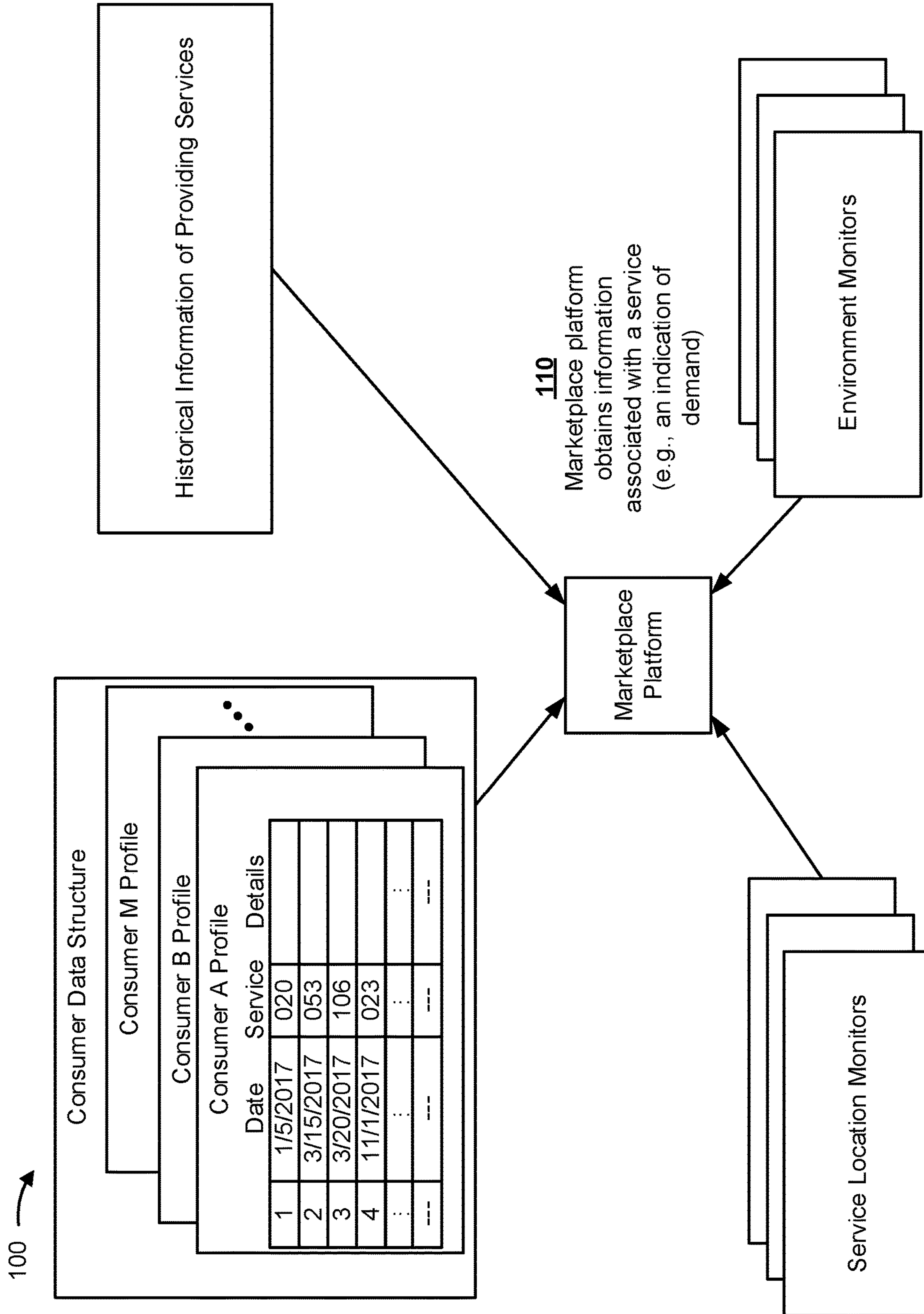


FIG. 1A



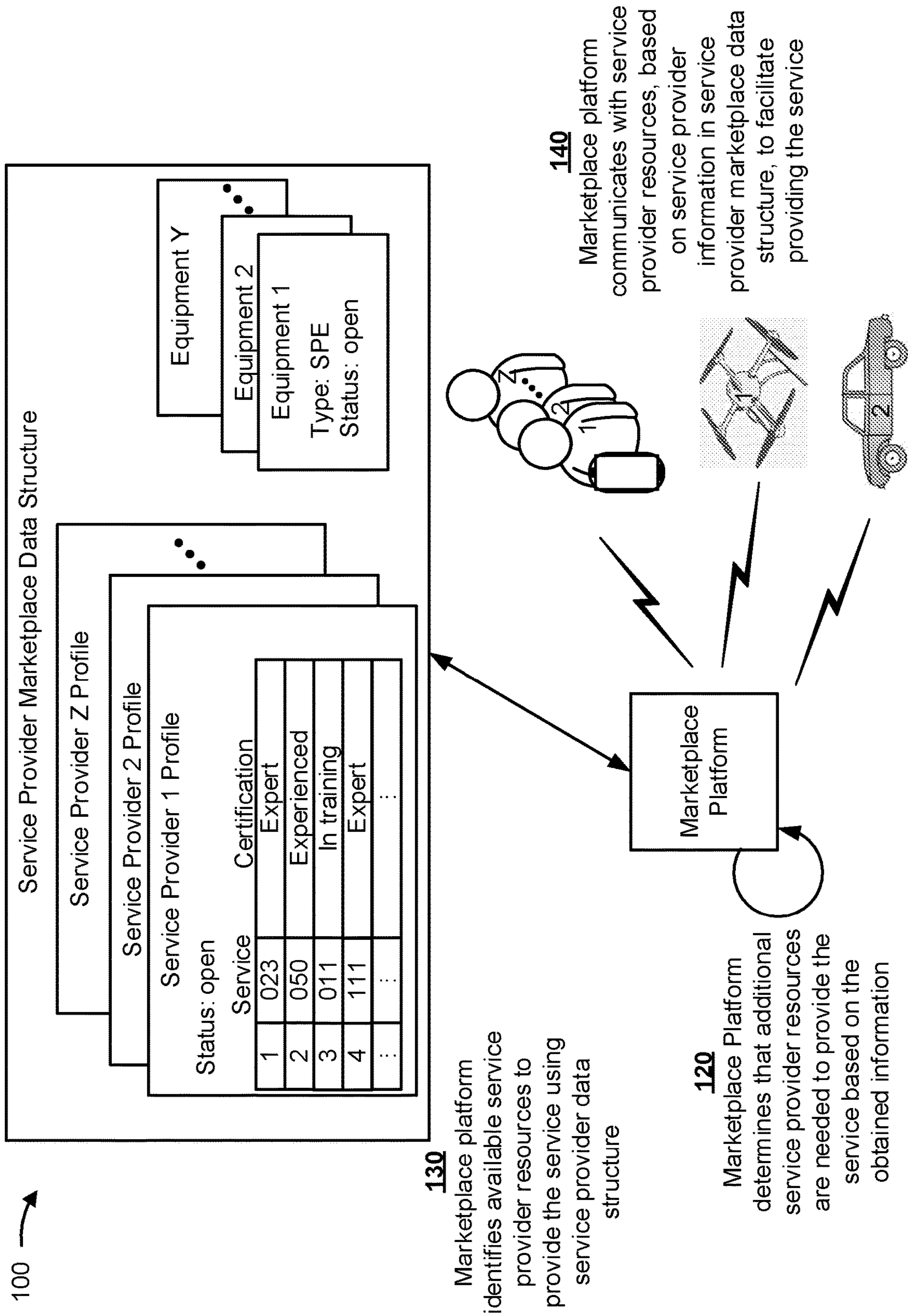


FIG. 1B

200 →

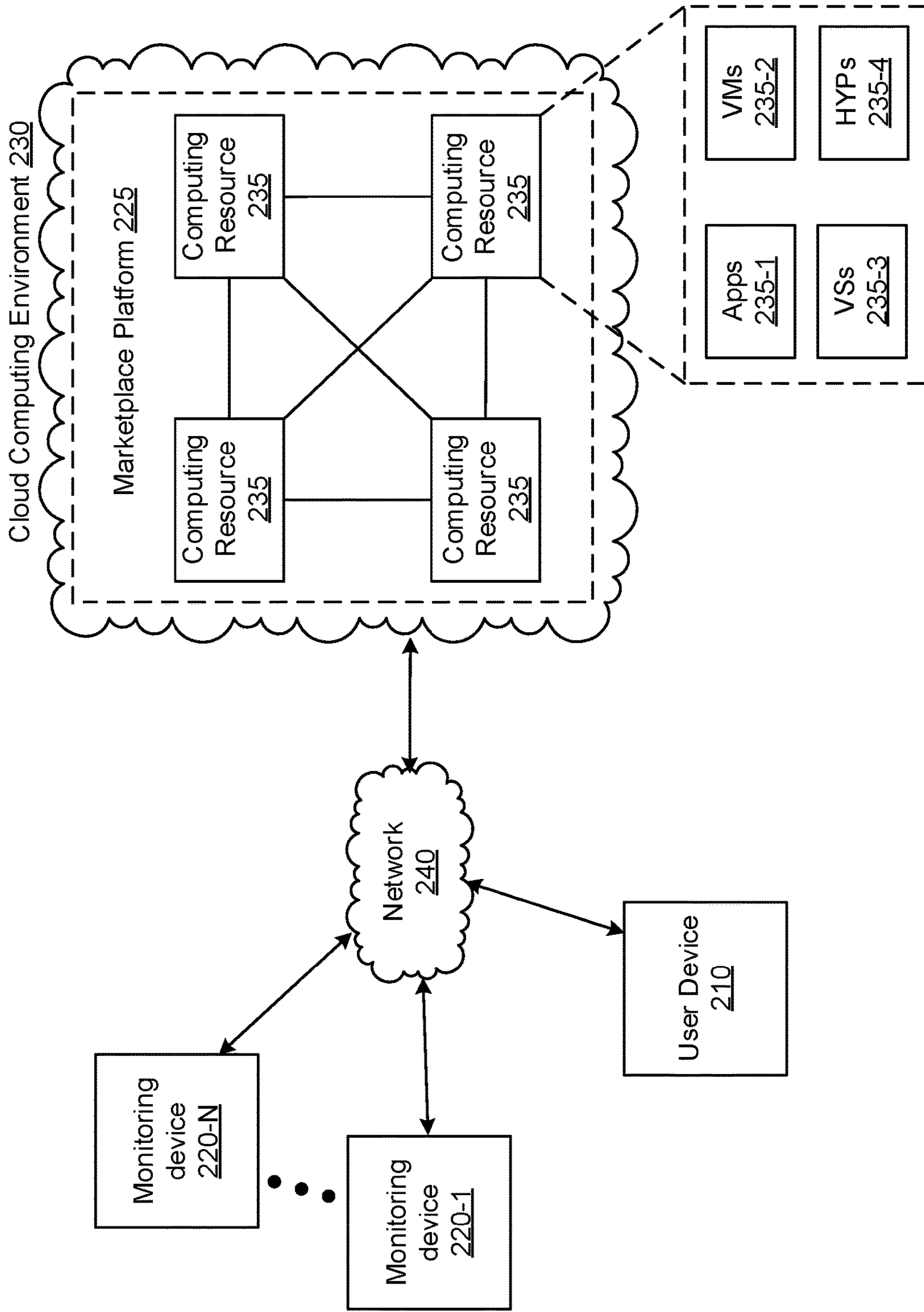


FIG. 2

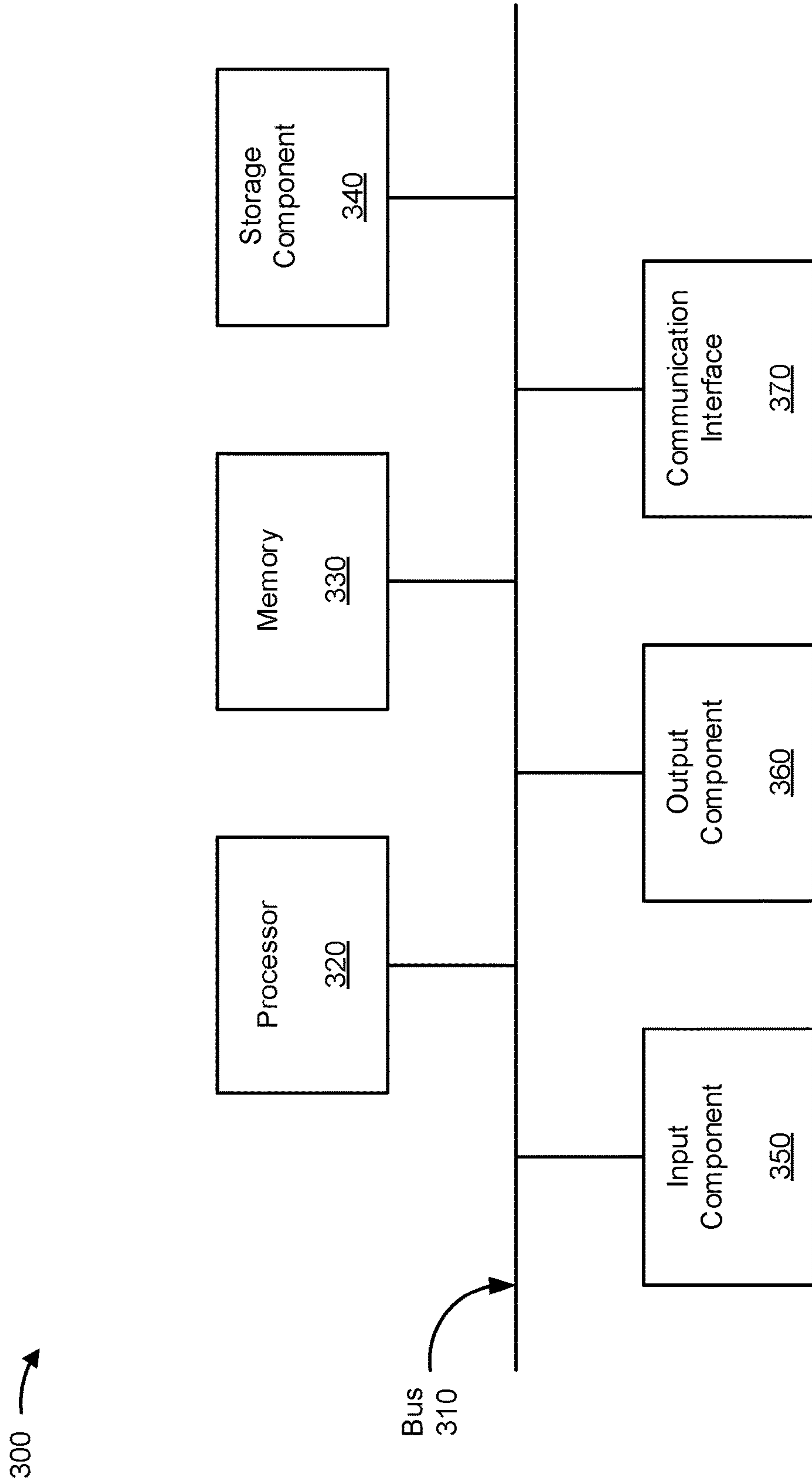


FIG. 3

400 →

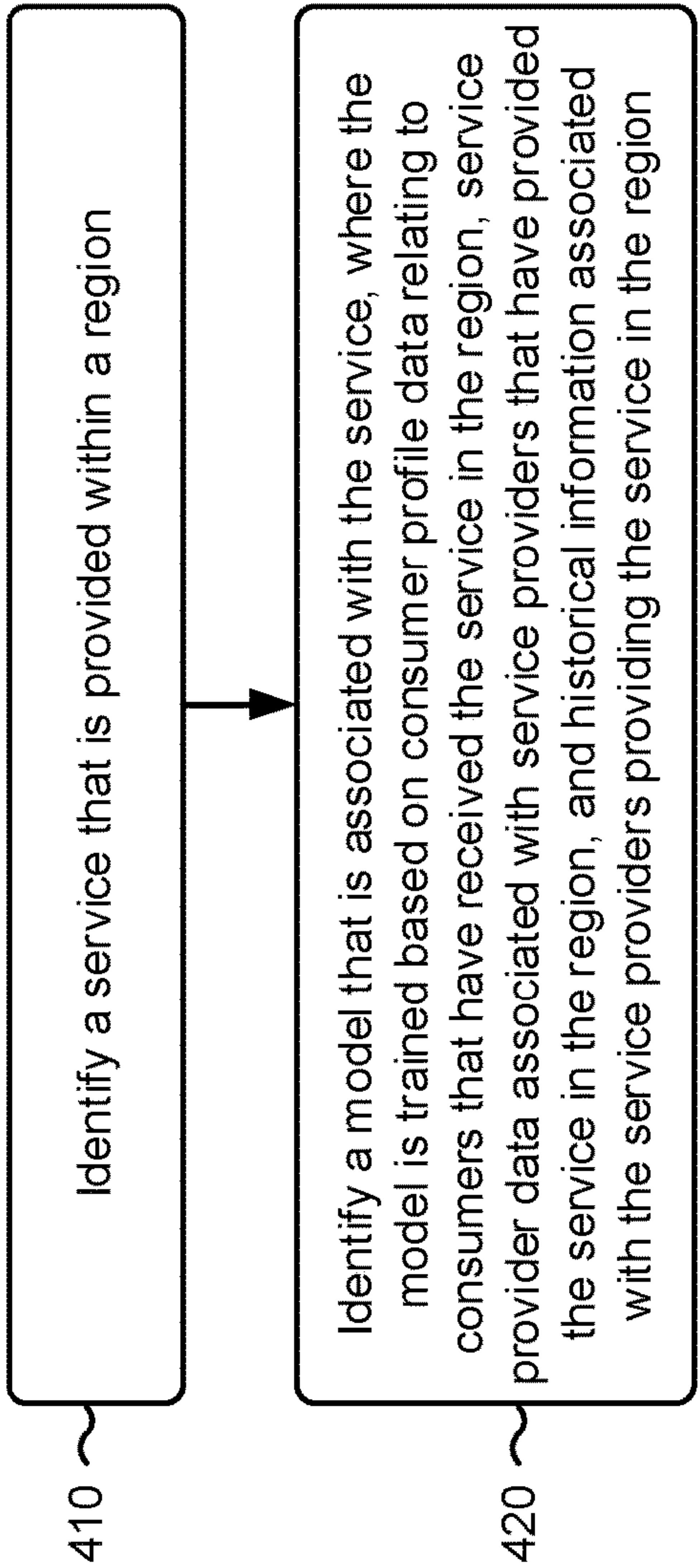


FIG. 4



500 →

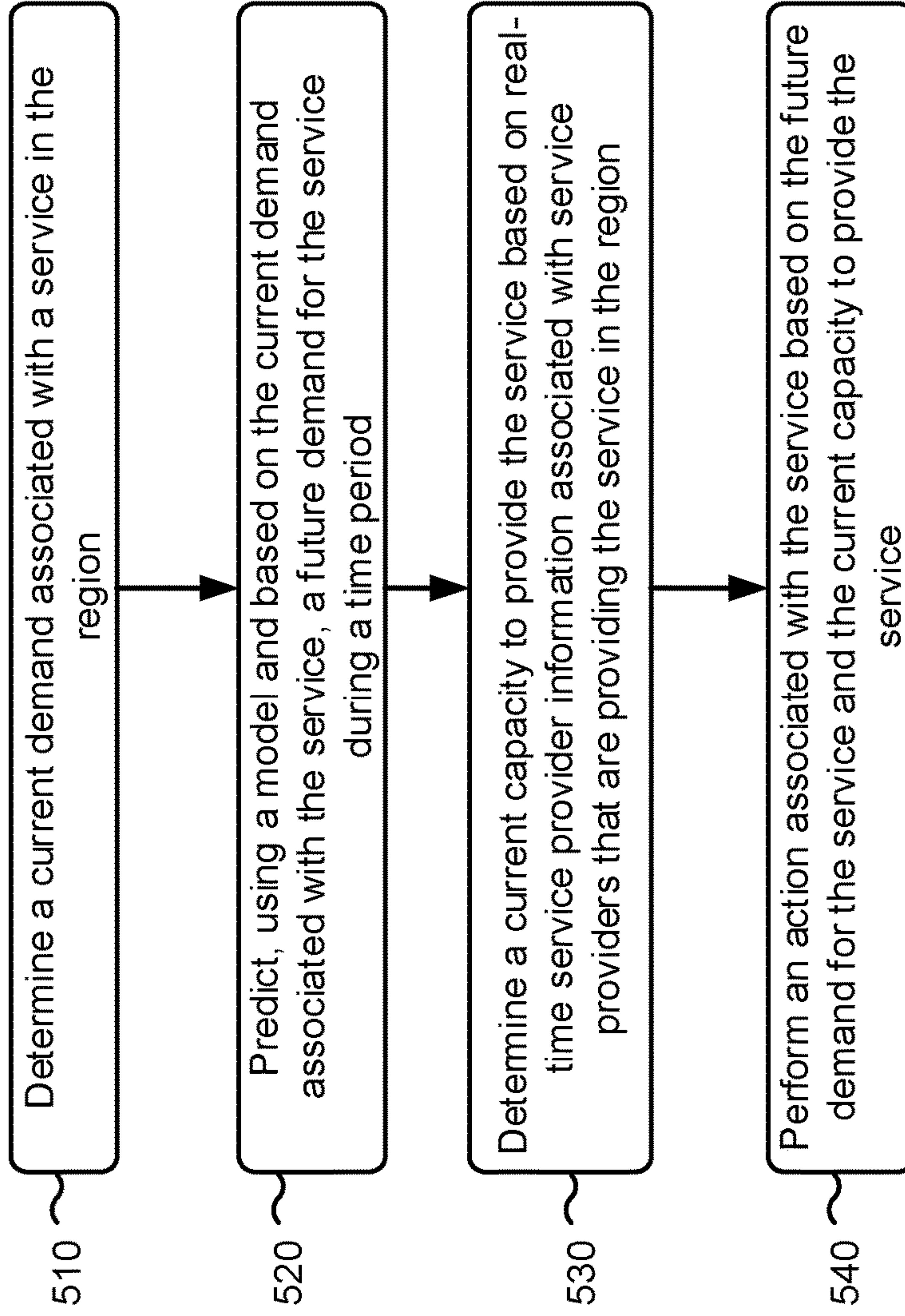


FIG. 5



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## ALLOCATION OF SERVICE PROVIDER RESOURCES BASED ON A CAPACITY TO PROVIDE THE SERVICE

### RELATED APPLICATION

This application is a continuation of U.S. patent application Ser. No. 15/847,146, filed Dec. 19, 2017, which is incorporated herein by reference.

### BACKGROUND

In many instances, organizations employ staff members (e.g., employees) to provide a service. Additionally, or alternatively, organizations may use independent contractors, and/or the like to provide the service. In some instances, organizations may utilize machines, such as vehicles, unmanned aerial vehicles (UAVs) (e.g., drones), kiosks, self-serve terminals, and/or the like to provide a service.

### SUMMARY

According to some implementations, one or more devices may include one or more memories and one or more processors, communicatively connected to at least one of the one or more memories, to identify a service that is provided within a region; identify a model that is associated with the service, the model having been trained based on consumer profile data relating to consumers that have received the service in the region, service provider data associated with service providers that have provided the service in the region, and historical information associated with providing the service in the region; determine a current demand associated with the service in the region; predict, using the model and based on the current demand associated with the service, a future demand for the service during a time period; determine a current capacity to provide the service based on real-time service provider information associated with service providers that are providing the service in the region; and perform an action associated with the service based on the future demand for the service and the current capacity to provide the service.

According to some implementations, a non-transitory computer-readable medium storing instructions that, when executed by one or more processors, cause the one or more processors to: identify a service that is provided within a region; train a model that is associated with the service based on: consumer trends in consumer profile data relating to consumers that have received the service in the region, service provider trends in service provider data associated with service providers that have provided the service in the region, and historical trends in historical information associated with providing the service in the region; determine a current demand for the service in the region; predict, using the model and based on the current demand for the service, a future demand for the service during a time period; determine a current capacity to provide the service during the time period based on real-time service provider information associated with service providers that are providing the service in the region; and perform an action associated with the service based on the future demand for the service and the current capacity to provide the service during the time period.

According to some implementations, a method may include identifying, by one or more devices, a service that is provided within a region; obtaining, by one or more devices,

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a model that is associated with the service, the model having been trained based on consumer profile data relating to consumers that have received the service in the region, service provider data associated with service providers that have provided the service in the region, and historical information associated with providing the service in the region; determining, by the one or more devices, a current demand associated with the service in the region; predicting, by the one or more devices, using the model, and based on the current demand associated with the service, a future demand for the service during a time period; determining, by the one or more devices, a current capacity to provide the service based on real-time service provider information for devices associated with particular service providers that are providing the service in the region; comparing, via the one or more devices, the current capacity to provide the service and the future demand for the service to determine whether the current capacity is capable of meeting the future demand for the service; and performing, via the one or more devices, an action associated with the service based whether the current capacity is capable of meeting the future demand for the service.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A and 1B are diagrams of an overview of an example implementation described herein;

FIG. 2 is a diagram of an example environment in which systems and/or methods, described herein, may be implemented;

FIG. 3 is a diagram of example components of one or more devices of FIG. 2;

FIG. 4 is a flow chart of an example process for allocating service provider resources based on a capacity to provide the service; and

FIG. 5 is a flow chart of another example process for allocating service provider resources based on a capacity to provide the service.

### DETAILED DESCRIPTION

The following detailed description of example implementations refers to the accompanying drawings. The same reference numbers in different drawings may identify the same or similar elements.

In many instances, a service provider organization (e.g., a financial institution (e.g., a bank, a credit union, and/or the like), a healthcare organization (e.g., a hospital, a clinic, an urgent care center, and/or the like), a law firm, an accounting firm, and/or the like) staffs service providers (e.g., individuals, such as employees, independent contractors, and/or the like) at one or more service locations (e.g., a bank branch, a hospital, firm offices, and/or the like). Accordingly, an amount of service providers employed by a particular service provider organization and/or an amount of service provider equipment used to provide the service may be limited to an amount of space available at the one or more service locations of the service provider organization. Furthermore, location(s) of the one or more service locations may limit a service provider organization's ability to provide a service to within a certain range of the service location(s) of the service provider organization.

As such, in many instances, during particular time periods, the service provider organizations may be understaffed and/or underequipped to provide a particular service. For example, during tax season, banks or accounting firms may need to temporarily hire additional staff and, during holi-



days, retailers, transportation companies, and/or other types of organizations may need to do the same. As another example, during a natural disaster, in general for both service provider and consumer, resources can be drastically limited as an entire region attempts to recover from the natural disaster. Some implementations described herein provide a marketplace platform to facilitate adjusting an amount of service provider resources available to provide a service. The available service provider resources may include service providers (e.g., individuals or personnel that provide the service or facilitate providing the service, such as employees of the service provider organization, independent contractors, and/or the like) and/or service provider equipment (e.g., one or more machines that provide the service or facilitate providing the service) that can be made available to provide a service or withdraw from providing the service, during a particular time period, according to a predicted demand for the service.

According to some implementations described herein, a model may be trained based on a set of data (e.g., consumer related data, service provider related data, and/or historical information) and used to predict a future demand for a service during a particular time period. In some implementations, a current demand for the service may be monitored and/or analyzed to predict the future demand for the service. Further, based on the future demand and a capacity to provide a service, a marketplace platform may facilitate increasing or decreasing service provider resources in accordance with the future demand. For example, the marketplace platform may have access to a service provider organization's resources, availability of additional service providers (such as employees (e.g., remote employees, off duty employees, and/or the like), independent contractors that are capable of providing the service or potentially capable of providing the service, and/or the like), additional available service provider equipment (e.g., autonomous (or semi-autonomous) vehicles (e.g., autonomous cars, an autonomous trucks, an autonomous semi-tractors or autonomous semi-tractor trailer combinations, and/or the like), an unmanned aerial vehicle (UAV) (e.g., a drone), portable kiosks (e.g., kiosks that may be included within or attached to one or more autonomous vehicles), transaction terminals, and/or the like) for use in meeting the future demand.

Accordingly, the marketplace platform may enable the service provider organization to quickly and efficiently adjust service provider resources to meet a demand for a service. As such, service provider organizations may avoid turning away consumers (e.g., and losing profits, losing good will, losing an ability to meet a consumer's needs (which can be critical)). Further, some implementations herein may avoid wasting computing resources due to having an unnecessary amount of equipment available. In some implementations, networking resources may be conserved due to unnecessary communications over a network, due to avoiding receiving requests for service from consumers, due to avoiding receiving requests from service providers to be available to provide a service, and/or the like. Additionally, or alternatively, power resources may be conserved due to avoiding unnecessary equipment from being powered on and/or in use.

FIGS. 1A and 1B are diagrams of an overview of an example implementation 100 described herein. In example implementation 100 of FIGS. 1A and 1B, a marketplace platform facilitates allocation of resources to provide a service based on a predicted demand for the service.

As shown in FIG. 1A, and by reference number 110, the marketplace platform obtains information associated with a

service. In such cases, the information associated with the service may be used to indicate a demand. For example, as shown in FIG. 1A, a consumer data structure may include M consumer profiles ( $M \geq 1$ ) corresponding to M consumers of a particular service provider organization. Such consumer profiles may include consumer data for a particular region (e.g., a town or city, a county, a state, and/or the like) or service location of a service provider organization. As shown in FIG. 1A, the consumer data may identify a number of times that the M consumers received a particular service, when the service was received, what service was received, and/or detailed information about the provided service.

Furthermore, as shown in FIG. 1A, the marketplace platform may receive historical information associated with the service. In some implementations, the historical information associated with the service may be based on a region that is larger than the region associated with the consumer data (e.g., state wide region, a country wide region). The historical information may include a service log for the service, which may represent or indicate information corresponding to occurrences of when the service was provided.

As further shown in FIG. 1A, the marketplace platform receives information associated with the service from service location monitors and environmental monitors. The service location monitors and environmental monitors may be associated with a same region of a service provider organization as the consumer data of the consumer data structure.

In some implementations, the service location monitors of example implementation 100 may include transaction terminals (e.g., payment terminals, kiosks, self-service terminals, and/or the like) that facilitate providing the service. A status of the transaction terminals, indicating whether the transaction terminals are active, idle, or powered off, may be obtained by the marketplace platform. Additionally, or alternatively, the service location monitors may include cameras and/or sensors that may provide images or data that can be analyzed to identify a number of individuals (e.g., consumers, service providers, and/or the like) at the location. The environmental monitors may include devices that monitor environmental factors associated with or that affect the service. For example, the environment monitors may include one or more devices or feeds providing weather-related information, traffic-related information, social media activity or social media trends, breaking news, and/or the like. Accordingly, marketplace platform may use the obtained information (e.g., the status of the transaction terminals, the number of people at a service location, the environmental factors, and/or the like) from the service location monitors and the environmental monitors to determine a current demand or future demand for a service.

As shown in FIG. 1B, and by reference number 120, the marketplace platform determines that additional service provider resources (e.g., additional service providers and/or additional service provider equipment) are needed to provide the service based on the obtained information. For example, from the obtained information, the marketplace platform may predict a future demand for the service (e.g., using a model that is trained from the obtained data) during a particular time period (e.g., an upcoming week, an upcoming month, an upcoming season, and/or the like). In some implementations, the marketplace platform may compare the future demand to a capacity for the service provider organization to provide the service (e.g., based on information from the service location monitors, based on scheduling information associated with service providers or service provider equipment and/or the like).



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As further shown in FIG. 1B, and by reference number **130**, the marketplace platform identifies available service provider resources (e.g., service providers and/or service provider equipment) to provide the service using service provider data. For example, as shown, the marketplace platform may refer to a service provider marketplace data structure that includes information associated with service providers and/or service provider equipment that may or may not be associated with a particular service provider organization. Accordingly, the marketplace platform may identify additional service providers and/or service provider resources to facilitate providing the service during the time period associated with the future demand. As shown, the service provider marketplace data structure may indicate qualifications and/or availability of the service providers and type and/or availability of the equipment.

As further shown in FIG. 1B, and by reference number **140**, the marketplace platform communicates with service provider resources, based on the service provider information in the service provider marketplace data structure, to facilitate providing the service. For example, the marketplace platform may identify one or more available service providers, and send a notification to a user device of the service provider indicating that the service provider is to provide the service during the time period. In some implementations, the notification may include a request to provide the service (which may be accepted or denied by the service provider). In some implementations, the notification may provide qualification information associated with providing the service (e.g., so that the service provider may become qualified to provide the service before the time period associated with the future demand). Additionally, or alternatively, the marketplace platform may communicate with the service provider equipment. For example, the marketplace platform may control or facilitate controlling the service provider equipment to be available to provide the service during the time period associated with the future demand. In some implementations, a notification may be sent to a service provider to use the service provider equipment and/or retrieve the service provider equipment to provide the service during the time period associated with the future demand for the service.

Accordingly, the marketplace platform of example implementation **100** enables a service provider organization to scale service provider resources appropriately based on predicted future demand for a service. As such, the marketplace platform may be used to allocate appropriate amounts of resources to provide a service to ensure that consumers' needs for the service are met and/or to ensure that resources (e.g. computing resources, network resources, power resources, hardware resources, equipment, and/or the like) are conserved by allocating the appropriate amount of resources (i.e., over allocation of resources can be avoided).

As indicated above, FIGS. 1A and 1B are provided merely as an example. Other examples are possible and may differ from what was described with regard to FIGS. 1A and 1B.

FIG. 2 is a diagram of an example environment **200** in which systems and/or methods, described herein, may be implemented. As shown in FIG. 2, environment **200** may include a service provider device **210**, one or more monitoring devices **220-1** through **220-N** ( $N \geq 1$ ) (hereinafter referred to collectively as "monitoring devices **220**," and individually as "monitoring device **220**"), a marketplace platform **225** hosted within a cloud computing environment **230**, and a network **240**. Devices of environment **200** may interconnect via wired connections, wireless connections, or a combination of wired and wireless connections.

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Service provider device **210** includes one or more devices capable of receiving, generating, storing, processing, and/or providing information associated with identifying a service, providing a service, and/or determining a status of a service according to some implementations described herein. For example, service provider device **210** may include a user device with a communication and/or computing device, such as a mobile phone (e.g., a smart phone, a radiotelephone, etc.), a laptop computer, a tablet computer, a handheld computer, a gaming device, a wearable communication device (e.g., a smart wristwatch, a pair of smart eyeglasses, etc.), or a similar type of device. Further, service provider device **210** may include a device capable of providing a service. For example, service provider device **210** may include an autonomous (or semi-autonomous) vehicle (e.g., an autonomous car, an autonomous truck, an autonomous semi-tractor or autonomous semi-tractor trailer combination, and/or the like), a unmanned aerial vehicle (UAV) (e.g., a drone), a portable kiosk (e.g., a kiosk that may be included within or attached to an autonomous vehicle), a transaction terminal, and/or any other type of device capable of providing a service according to implementations described herein.

Monitoring device **220** includes one or more devices capable of receiving, generating, storing, processing, and/or providing information associated with a status of a service and/or demand for a service. For example, monitoring device **220** may include a communication device and a computing device, such as a transaction terminal (e.g., a payment terminal, a kiosk terminal, a self-service terminal, an automated teller machine (ATM) terminal, and/or the like), a camera, a sensor, a weather monitor, a traffic monitor, a social media feed (e.g., a social media activity feed, a social media trend feed, and/or the like), a breaking news feed, and/or the like. As such, monitoring device **220** may communicate with marketplace platform **225** to provide information associated with a status of a service and/or a demand for a service.

Marketplace platform **225** includes one or more devices (e.g., computing resources **235**) capable of monitoring a service according to implementations described herein. For example, marketplace platform **225** may be capable of monitoring the service via monitoring devices **220**; determining a current demand for the service based on information from the monitoring devices; and/or identifying, using, or training a model used to predict a future demand for the service. In some implementations, marketplace platform **225** may indicate or provide information associated with a service to service provider device **210**. For example, marketplace platform **225** may send instructions for providing a service to service provider device **210**, may send instructions to control service provider device **210** to be available to provide the service (e.g., during a particular time period and/or at a particular location).

Cloud computing environment **230** includes an environment that delivers computing as a service, whereby shared resources, services, and/or the like may be provided to service provider device **210**, and/or monitoring devices **220**. Cloud computing environment **230** includes an environment that hosts marketplace platform **225**. Cloud computing environment **230** may provide computation, software, data access, storage, and/or other services that do not require end-user knowledge of a physical location and/or configuration of a system and/or a device that delivers the services. As shown, cloud computing environment **230** may include a group of computing resources **235** (which may be referred to herein individually as computing resource **235**).



Notably, while implementations described herein describe marketplace platform **225** as being hosted in cloud computing environment **230**, in some implementations, marketplace platform **225** may not be cloud-based (i.e., may be implemented outside of a cloud computing environment) or may be partially cloud-based.

Computing resource **235** includes one or more personal computers, workstation computers, server devices, or another type of computation and/or communication device. In some implementations, one or more computing resources **235** may host marketplace platform **225**. The cloud resources may include compute instances executing in computing resource **235**, storage devices provided in computing resource **235**, data transfer devices provided by computing resource **235**, etc. In some implementations, computing resource **235** may communicate with other computing resources **235** via wired connections, wireless connections, or a combination of wired and wireless connections.

As further shown in FIG. 2, computing resource **235** may include a group of cloud resources, such as one or more applications (“APPs”) **235-1**, one or more virtual machines (“VMs”) **235-2**, virtualized storage (“VSs”) **235-3**, one or more hypervisors (“HYPs”) **235-4**, or the like.

Application **235-1** includes one or more software applications that may be provided to or accessed by service provider device **210**. Application **235-1** may eliminate a need to install and execute the software applications on service provider device **210**. For example, application **235-1** may include software associated with marketplace platform **225** and/or any other software capable of being provided via cloud computing environment **230**. In some implementations, one application **235-1** may send/receive information to/from one or more other applications **235-1**, via virtual machine **235-2**.

Virtual machine **235-2** includes a software implementation of a machine (e.g., a computer) that executes programs like a physical machine. Virtual machine **235-2** may be either a system virtual machine or a process virtual machine, depending upon use and degree of correspondence to any real machine by virtual machine **235-2**. A system virtual machine may provide a complete system platform that supports execution of a complete operating system (“OS”). A process virtual machine may execute a single program, and may support a single process. In some implementations, virtual machine **235-2** may execute on behalf of a user (e.g., via service provider device **210**), and may manage infrastructure of cloud computing environment **230**, such as data management, synchronization, or long-duration data transfers.

Virtualized storage **235-3** includes one or more storage systems and/or one or more devices that use virtualization techniques within the storage systems or devices of computing resource **235**. In some implementations, within the context of a storage system, types of virtualizations may include block virtualization and file virtualization. Block virtualization may refer to abstraction (or separation) of logical storage from physical storage so that the storage system may be accessed without regard to physical storage or heterogeneous structure. The separation may permit administrators of the storage system flexibility in how the administrators manage storage for end users. File virtualization may eliminate dependencies between data accessed at a file level and a location where files are physically stored. This may enable optimization of storage use, server consolidation, and/or performance of non-disruptive file migrations.

Hypervisor **235-4** provides hardware virtualization techniques that allow multiple operating systems (e.g., “guest operating systems”) to execute concurrently on a host computer, such as computing resource **235**. Hypervisor **235-4** may present a virtual operating platform to the guest operating systems, and may manage the execution of the guest operating systems. Multiple instances of a variety of operating systems may share virtualized hardware resources.

Network **240** includes one or more wired and/or wireless networks. For example, network **240** may include a cellular network (e.g., a long-term evolution (LTE) network, a code division multiple access (CDMA) network, a 3G network, a 4G network, a 5G network, another type of next generation network, etc.), a public land mobile network (PLMN), a local area network (LAN), a wide area network (WAN), a metropolitan area network (MAN), a telephone network (e.g., the Public Switched Telephone Network (PSTN)), a private network, an ad hoc network, an intranet, the Internet, a fiber optic-based network, a cloud computing network, or the like, and/or a combination of these or other types of networks.

The number and arrangement of devices and networks shown in FIG. 2 are provided as an example. In practice, there may be additional devices and/or networks, fewer devices and/or networks, different devices and/or networks, or differently arranged devices and/or networks than those shown in FIG. 2. Furthermore, two or more devices shown in FIG. 2 may be implemented within a single device, or a single device shown in FIG. 2 may be implemented as multiple, distributed devices. Additionally, or alternatively, a set of devices (e.g., one or more devices) of environment **200** may perform one or more functions described as being performed by another set of devices of environment **200**.

FIG. 3 is a diagram of example components of a device **300**. Device **300** may correspond to service provider device **210**, monitoring device **220**, marketplace platform **225**, or computing resource **235**. In some implementations, service provider device **210**, monitoring device **220**, marketplace platform **225**, and/or computing resource **235** may include one or more devices **300** and/or one or more components of device **300**. As shown in FIG. 3, device **300** may include a bus **310**, a processor **320**, a memory **330**, a storage component **340**, an input component **350**, an output component **360**, and a communication interface **370**.

Bus **310** includes a component that permits communication among the components of device **300**. Processor **320** is implemented in hardware, firmware, or a combination of hardware and software. Processor **320** is a central processing unit (CPU), a graphics processing unit (GPU), an accelerated processing unit (APU), a microprocessor, a microcontroller, a digital signal processor (DSP), a field-programmable gate array (FPGA), an application-specific integrated circuit (ASIC), or another type of processing component. In some implementations, processor **320** includes one or more processors capable of being programmed to perform a function. Memory **330** includes a random access memory (RAM), a read only memory (ROM), and/or another type of dynamic or static storage device (e.g., a flash memory, a magnetic memory, and/or an optical memory) that stores information and/or instructions for use by processor **320**.

Storage component **340** stores information and/or software related to the operation and use of device **300**. For example, storage component **340** may include a hard disk (e.g., a magnetic disk, an optical disk, a magneto-optic disk, and/or a solid state disk), a compact disc (CD), a digital versatile disc (DVD), a floppy disk, a cartridge, a magnetic



tape, and/or another type of non-transitory computer-readable medium, along with a corresponding drive.

Input component **350** includes a component that permits device **300** to receive information, such as via user input (e.g., a touch screen display, a keyboard, a keypad, a mouse, a button, a switch, and/or a microphone). Additionally, or alternatively, input component **350** may include a sensor for sensing information (e.g., a global positioning system (GPS) component, an accelerometer, a gyroscope, and/or an actuator). Output component **360** includes a component that provides output information from device **300** (e.g., a display, a speaker, and/or one or more light-emitting diodes (LEDs)).

Communication interface **370** includes a transceiver-like component (e.g., a transceiver and/or a separate receiver and transmitter) that enables device **300** to communicate with other devices, such as via a wired connection, a wireless connection, or a combination of wired and wireless connections. Communication interface **370** may permit device **300** to receive information from another device and/or provide information to another device. For example, communication interface **370** may include an Ethernet interface, an optical interface, a coaxial interface, an infrared interface, a radio frequency (RF) interface, a universal serial bus (USB) interface, a Wi-Fi interface, a cellular network interface, or the like.

Device **300** may perform one or more processes described herein. Device **300** may perform these processes based on processor **320** executing software instructions stored by a non-transitory computer-readable medium, such as memory **330** and/or storage component **340**. A computer-readable medium is defined herein as a non-transitory memory device. A memory device includes memory space within a single physical storage device or memory space spread across multiple physical storage devices.

Software instructions may be read into memory **330** and/or storage component **340** from another computer-readable medium or from another device via communication interface **370**. When executed, software instructions stored in memory **330** and/or storage component **340** may cause processor **320** to perform one or more processes described herein. Additionally, or alternatively, hardwired circuitry may be used in place of or in combination with software instructions to perform one or more processes described herein. Thus, implementations described herein are not limited to any specific combination of hardware circuitry and software.

The number and arrangement of components shown in FIG. **3** are provided as an example. In practice, device **300** may include additional components, fewer components, different components, or differently arranged components than those shown in FIG. **3**. Additionally, or alternatively, a set of components (e.g., one or more components) of device **300** may perform one or more functions described as being performed by another set of components of device **300**.

FIG. **4** is a flow chart of an example process **400** for allocating service provider resources based on a capacity to provide the service. In some implementations, one or more process blocks of FIG. **4** may be performed by marketplace platform **225**. In some implementations, one or more process blocks of FIG. **4** may be performed by another device or a group of devices separate from or including marketplace platform **225**, such as service provider device **210** or monitoring device **220**.

As shown in FIG. **4**, process **400** may include identifying a service that is provided within a region (block **410**). For example, marketplace platform **225** may identify the service. In some implementations, marketplace platform **225** iden-

tifies the service based on the service being included within a data structure associated with marketplace platform **225**, based on receiving an identifier associated with the service, based on receiving a user input, and/or the like.

According to some implementations, a service may include any action or interaction that may be purchased or received by an individual (e.g., via a service provider or service provider equipment). In some implementations, the service may include a banking service (e.g., a banking account service, an ATM service, a transaction card service (e.g., to request or receive a new transaction card), an investment banking service, a loan service, and/or the like). Additionally, or alternatively, the service may include a healthcare service, a legal service, an accounting service, an emergency response service, a security service, and/or the like.

According to some implementations, a region may correspond to an area or location that is serviced by a service provider organization. Accordingly, the region may be a geographical area, a building, a campus, and/or the like. In some implementations, the region may correspond to a particular town, city, county, state, country, and/or the like.

Marketplace platform **225** may identify the service that is provided in the region based on monitoring devices associated with a particular service location and/or receiving information with a particular service location. In some implementations, marketplace platform **225** may determine the region from locations of the service locations. For example, marketplace platform **225** may identify geographical coordinates of the service locations and determine the region based on the geographical coordinates and a particular range or distance from the geographical coordinates.

In this way, marketplace platform **225** may identify a service that is provided within a region to enable marketplace platform **225** to identify a model associated with the service.

As further shown in FIG. **4**, process **400** may include identifying a model that is associated with the service, where the model is trained based on consumer profile data relating to consumers that have received the service in the region, service provider data associated with service providers that have provided the service in the region, and historical information associated with providing the service; (block **420**). For example, marketplace platform **225** may identify the model associated with the service. In some implementations, marketplace platform **225** may identify the model based on identifying a service that is provided in a region, based on receiving a request (e.g., from service provider device **210**), based on receiving a user input, based on an event (e.g., current demand for the service reaches a threshold, an update to the model, a change in data to the model, and/or the like), and/or the like.

Consumer profile data includes data relating to consumers that have received the service in the region. For example, the consumer profile data may include, for each consumer that received the service in the region, a number of times the consumer received the service, times and/or dates that the consumer received the service, a service provider and/or service provider equipment that provided the service, feedback associated with the provided service, and/or the like. In some implementations, marketplace platform **225** may maintain a consumer profile data structure, to store consumer profile data, that is updated (e.g., periodically or aperiodically) as consumers receive the service within the region.

Service provider data includes data associated with service providers that have provided the service in the region.



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For example, the service provider data may include, for each service provider (and/or service provider equipment), a number of times that the service provider provided the service, times and/or dates that the service provider provided the service, a consumer that received the provided service, service provider equipment used to provide the equipment, and/or the like. In some implementations, marketplace platform **225** may maintain a service provider data structure, to store service provider data, that is updated as service providers provide the service in the region.

Historical information associated with providing the service may include information about the service being provided outside of the region. For example, historical information may provide information associated with a region that is larger than the region associated with the consumer data and/or the service provider data. As such, the historical information may provide high level information associated with the service. For example, the historical information may include when the service was initially provided, a frequency at which the service has been provided (e.g., over time or during certain time periods), and/or the like.

In some implementations, marketplace platform **225** may train and/or implement machine learning to train the model. In some implementations, marketplace platform **225** may receive the model and/or receive information associated with the model. According to some implementations, the model may be any model that can be trained and/or updated according to changes in the consumer profile data, the service provider data, and/or the historical information (which may be referred to herein as “the data sets”). The data sets may include millions, billions, or trillions of data points regarding the service. As such, the model may be trained using such large data sets that cannot be processed objectively by a human individual.

In some implementations, the model may be a model that is trained using machine learning. The model may implement data cleansing (e.g., to obtain and/or preprocess the consumer profile data, service provider data, and/or historical information), (un)supervised training (which may split the data sets (e.g., as a whole or individually) for training purposes between test sets, validation sets, and training sets), classification, and/or other machine learning elements. The model may be created using a logistic regression, a Naïve Bayesian classifier, and/or a support vector machine (SVM) classifier. In some implementations, the model may include a natural language processing model (e.g., to identify terms or words associated with providing a service in the data sets)

According to some implementations, the model may be trained to identify trends that indicate past demand for the service using the consumer profile data, the service provider data, and the historical information. For example, the trends may identify recurrences within the data (e.g., during certain time periods). For example, the model may identify consumer trends in consumer profile data relating to consumers that have received the service in the region, service provider trends in service provider data associated with service providers that have provided the service in the region, and/or historical trends in the historical information.

In some implementations, the model may be trained to estimate a number of times the service is to be provided during a time period (e.g., a future time period). For example, using a current demand, marketplace platform **225** may refer to the model to predict a future demand for the service during the time period.

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In this way, marketplace platform **225** may identify or obtain a model associated with the service and/or determining or predicting a demand associated with the service.

Although FIG. **4** shows example blocks of process **400**, in some implementations, process **400** may include additional blocks, fewer blocks, different blocks, or differently arranged blocks than those depicted in FIG. **4**. Additionally, or alternatively, two or more of the blocks of process **400** may be performed in parallel.

FIG. **5** is a flow chart of an example process **500** for allocating service provider resources based on a capacity to provide the service. In some implementations, one or more process blocks of FIG. **5** may be performed by marketplace platform **225**. In some implementations, one or more process blocks of FIG. **5** may be performed by another device or a group of devices separate from or including marketplace platform **225**, such as service provider device **210** or monitoring device **220**. In some implementations, process **500** may be performed based on results of process **400**, in parallel with process **400**, and/or after process **400**.

As shown in FIG. **5**, process **500** may include determining a current demand associated with the service in the region (block **510**). For example, marketplace platform **225** may determine the current demand for the service. In some implementations, marketplace platform **225** determines the current demand based on usage or a rate of providing the service satisfying a threshold, based on an event (e.g., an environmental event), based on a request from a service location and/or service provider device **210**, based on a user input, and/or the like.

A current demand may reflect a rate at which a service is currently being provided to consumers. According to some implementations, the current demand may be determined based on real-time usage data associated with service providers that are currently providing the service in the region. The example real-time usage data may indicate current usage (e.g., within milliseconds) of one or more transaction terminals, service provider equipment, and/or service provider device **210** associated with the service. For example, a percentage of transaction terminals, service provider equipment, and/or service provider devices **210** in use may indicate a corresponding current demand (e.g., depending on the service). As such, in some implementations, marketplace platform **225** may obtain the real-time usage data may virtually immediately from monitoring devices **220** (e.g., via status indicators indicating that transaction terminal or other service provider equipment that is in use is active or inactive) to determine the current demand.

In some implementations, marketplace platform **225** may use real-time environment data to determine current demand. In some implementations, the environment data may be received from monitoring devices **220** and/or service provider devices **210**. As an example, monitoring device **220** may provide traffic information associated with traffic within the region. If the traffic information indicates a high density of traffic within the region, depending on the service, the high density may indicate a higher or lower current demand for the service.

In some implementations, marketplace platform **225** may use a model (e.g., a machine learning model as described herein) to determine the current demand. As such, real-time usage data and/or real-time environment data may be tracked and/or updated according to the model to determine the current demand. In some implementations, the model to determine the current demand may include a natural language processing model to identify key terms, words, or



phrases associated with the service (e.g., from social media feeds, breaking news feeds, and/or the like).

In this way, marketplace platform **225** may determine a current demand for the service to enable the marketplace platform to predict a future demand for the service.

As further shown in FIG. 5, process **500** may include predicting, using the model and based on the current demand associated with the service, a future demand for the service during a time period (block **520**). For example, marketplace platform **225** may predict the future demand. In some implementations, marketplace platform **225** may predict the future demand based on determining the current demand, based on an event occurring, based on receiving a user input, and/or the like.

A future demand corresponds to a demand for the service during a future time period. The future time period may be a quantity of hours from a current time period, a quantity of days from a current time period, a quantity of weeks from a current time period, a quantity of months from a current time period, and/or the like. The future demand may correspond to a number of times that the service is to be provided during the time period, and/or a rate at which the service is to be provided during the time period.

In some implementations, to determine the future demand, marketplace platform **225** may determine characteristics of the current demand for the service and predict the future demand using the model and based on the characteristics of the current demand. In such instances, the characteristics may correspond to a time (e.g., time of year, time of month, time of week, time of day, and/or the like), a location (e.g., a location of or within the region), environmental factors associated with the current demand (e.g., weather, traffic, news, social media trends, and/or the like). For example, the characteristics of the current demand may correspond to characteristics of a past demand identified or learned by the model. The marketplace platform **225**, using the model and information corresponding to a time period associated with the past demand, may predict a similar demand for the future demand (or at least a demand based on the past demand). As such, the marketplace platform **225** may use the model to predict the future demand based on the characteristics of the current demand.

In some implementations, marketplace platform **225** may predict the future demand based on a prediction model (e.g., linear regression, logistic regression, a decision tree, a random forest, a gradient boosting, a neural network, and/or the like). Additionally, or alternatively, marketplace platform **225** may utilize a machine learning model to predict the future demand. As such, the data sets, the current demand, and/or environment data may be trained within the model to predict the future demand.

In this way, marketplace platform **225** may predict a future demand for the service during a time period to permit marketplace platform **225** to determine whether a current capacity to provide the service can handle the future demand.

As further shown in FIG. 5, process **500** may include determining a current capacity to provide the service based on real-time service provider information associated with service providers that are providing the service in the region (block **530**). For example, marketplace platform **225** may determine the current capacity to provide the service. In some implementations, marketplace platform **225** determines the current capacity based on predicting the future demand.

A capacity to provide the service refers to an amount of service provider resources, of a service provider organiza-

tion, that are allocated to provide a service. Accordingly, a current capacity to provide a service may correspond to a current allocation of service provider resources, including service providers and/or service provider equipment capable of providing the service.

In some implementations, marketplace platform **225** may determine the current capacity based on real-time service provider information from service providers that are currently providing the service in the region. For example, marketplace platform **225** may determine an amount of service provider resources that are providing the service based on information from monitoring devices **220** (e.g., based on transaction terminal usage) and/or information from service provider devices **210**. Additionally, or alternatively, marketplace platform **225** may maintain a schedule associated with service provider resources that are providing the service. As such, marketplace platform **225** may refer to the schedule to identify an amount of service provider resources providing the service.

In this way, marketplace platform **225** may determine the current capacity to provide the service to enable marketplace platform **225** to perform an action based on the future demand for the service and the current capacity to provide the service.

As further shown in FIG. 5, process **500** may include performing an action associated with the service based on the future demand for the service and the current capacity to provide the service (block **540**). For example, marketplace platform **225** may perform the action. In some implementations, marketplace platform **225** may perform the action based on determining the future demand for the service, determining the current capacity to provide the service, and/or the like.

In some implementations, marketplace platform **225** may perform an action that includes comparing the future demand for the service and the current capacity to provide the service (e.g., in order to determine if the current capacity is sufficient to meet the future demand, to determine if the current capacity is excessive relative to the future demand, and/or the like). For example, when marketplace platform **225** determines that the future demand for the service exceeds the current capacity to provide the service, marketplace platform **225** may identify one or more additional service providers that are available to provide the service in the region. In such cases, marketplace platform **225** may perform an action that includes sending a notification (e.g., service provider device **210**) to the one or more additional service providers to be available to provide the service in the region.

According to some implementations, a notification may include a message, file, attachment, calendar invite, image, and/or the like. In some implementations, a notification may cause service provider device **210** to populate a calendar with an appointment, cause service provider device **210** to provide an alert (e.g., flash a light of service provider device **210**, activate a vibration mechanism of service provider device **210**, emit a sound from a speaker of service provider device **210**, and/or the like), cause service provider device **210** to indicate a time and/or location for providing the service, cause service provider device **210** to navigate a service provider to a location to provide the service, and/or the like. In some implementations, a notification may include an offer or request, which may be displayed via service provider device **210**, for a service provider to provide a service. In such cases, the offer or request may include an employment agreement or a service agreement that indicates compensation for providing the service.



Furthermore, in some implementations, marketplace platform **225** may perform an action that includes causing an account (e.g., a financial account, a rewards account, and/or the like) to be credited (e.g., with currency, with rewards points, and/or the like) for providing the service. In such cases, marketplace platform **225** may authorize such a transaction based on receiving a confirmation from service provider device **210** and/or service provider equipment that a service was completed.

In some implementations, a notification may cause an autonomous vehicle to go to a location (e.g., to pick one or more service providers or service provider equipment, to facilitate providing the service, and/or the like), cause a UAV to go to a location, and/or the like. Accordingly, marketplace platform **225** may perform an action that includes automatically controlling one or more machines of the one or more additional service providers (e.g., service provider equipment) to relocate to a particular location of the region to facilitate providing the service during the time period. In some implementations, marketplace platform **225** may determine a location of interest for providing the service within the region. For example, the location of interest may be determined based on the future demand for the service and locations of providing the service indicated in the consumer profile data, locations of providing the service in the service provider data, and/or locations of providing the service in the historical information. As such, using location information from the data sets of the model, marketplace platform **225** may determine a relatively optimal location for service provider equipment and/or service providers to provide a service within the region.

In some implementations, marketplace platform **225** may cause deployment of the service provider equipment using one or more of an address, navigational instructions, traffic information, and/or the like. In some implementations, marketplace platform **225** may determine a departure time and/or arrival time for the service provider equipment based on the time period associated with the future demand and/or a distance between the service provider equipment and the location of interest.

In some implementations, marketplace platform **225** may perform an action that includes identifying one or more potential additional service providers that may provide the service but are not qualified to provide the service (e.g., due to lack of experience, lack of being certified, and/or the like). In such cases, marketplace platform **225** may transmit qualification information to the one or more potential additional service providers to enable the one or more additional service providers to be qualified and available to provide the service during the time period. For example, marketplace platform **225** may obtain qualification information (e.g., from a website, from certification database, and/or the like) and provide the qualification information to service provider device **210**. In such cases, the qualification information may identify the needed certification, may include information associated with a class (e.g., in person class, online class, and/or the like) to become certified, may include time or location for the class, and/or the like.

In some implementations, when marketplace platform **225** determines that the current capacity to provide the service exceeds the future demand for the service, marketplace platform **225** may identify one or more service providers that are providing the service in the region. In such cases, marketplace platform **225** may notify the one or more of the service providers to cease providing the service in the region. For example, marketplace platform **225** may send a notification to service provider device **210**, instructing ser-

vice provider device **210** to cease providing the service. In some implementations, marketplace platform **225** may cause service provider equipment (e.g., autonomous vehicles, autonomous UAVs, and/or the like) to return to a storage location. For example, marketplace platform **225** may provide an address and/or navigation instructions to reach the storage location in a similar manner as providing the address and navigation instructions to the location of interest to provide the service.

In this way, marketplace platform **225** may perform an action based on the future demand for the service and the current capacity to provide the service.

Although FIG. **5** shows example blocks of process **500**, in some implementations, process **500** may include additional blocks, fewer blocks, different blocks, or differently arranged blocks than those depicted in FIG. **5**. Additionally, or alternatively, two or more of the blocks of process **500** may be performed in parallel.

According to some implementations described herein, a marketplace platform enables a service provider organization to scale service provider resources (e.g., service providers and/or service provider equipment) according to a determined demand (e.g., future demand) for the service. As such, a model and current demand (which may be based on real-time usage and/or environmental factors) may be used to determine a future demand for the service. Based on the future demand, and a current capacity of the service provider organization, the service provider organization may either increase or decrease service provider resources (e.g., within a particular region). As such, some implementations enable a service provider organization to provision enough service provider resources to meet the needs of consumers while avoiding over staffing and/or over deploying service provider equipment to provide the service. Accordingly, the service provider organization may increase revenue and/or profits and meet the needs of potential consumers while conserving computing resources, network resources, power resources, and/or hardware resources used to provide the service.

The foregoing disclosure provides illustration and description, but is not intended to be exhaustive or to limit the implementations to the precise form disclosed. Modifications and variations are possible in light of the above disclosure or may be acquired from practice of the implementations.

As used herein, the term component is intended to be broadly construed as hardware, firmware, or a combination of hardware and software.

Some implementations are described herein in connection with thresholds. As used herein, satisfying a threshold may refer to a value being greater than the threshold, more than the threshold, higher than the threshold, greater than or equal to the threshold, less than the threshold, fewer than the threshold, lower than the threshold, less than or equal to the threshold, equal to the threshold, or the like.

It will be apparent that systems and/or methods, described herein, may be implemented in different forms of hardware, firmware, or a combination of hardware and software. The actual specialized control hardware or software code used to implement these systems and/or methods is not limiting of the implementations. Thus, the operation and behavior of the systems and/or methods were described herein without reference to specific software code—it being understood that software and hardware can be designed to implement the systems and/or methods based on the description herein.

Even though particular combinations of features are recited in the claims and/or disclosed in the specification,



these combinations are not intended to limit the disclosure of possible implementations. In fact, many of these features may be combined in ways not specifically recited in the claims and/or disclosed in the specification. Although each dependent claim listed below may directly depend on only one claim, the disclosure of possible implementations includes each dependent claim in combination with every other claim in the claim set.

No element, act, or instruction used herein should be construed as critical or essential unless explicitly described as such. Also, as used herein, the articles “a” and “an” are intended to include one or more items, and may be used interchangeably with “one or more.” Furthermore, as used herein, the term “set” is intended to include one or more items (e.g., related items, unrelated items, a combination of related and unrelated items, etc.), and may be used interchangeably with “one or more.” Where only one item is intended, the term “one” or similar language is used. Also, as used herein, the terms “has,” “have,” “having,” or the like are intended to be open-ended terms. Further, the phrase “based on” is intended to mean “based, at least in part, on” unless explicitly stated otherwise.

What is claimed is:

1. A method, comprising:

determining, by a device, a current demand associated with a service that is provided within a region;

identifying, by the device, a model that is associated with the service,

the model being trained based on:

consumer profile data relating to consumers that have received the service in the region,

service provider data associated with service providers that have provided the service in the region, and

historical information associated with the service providers providing the service in the region,

the model being trained using machine learning including at least one of:

data cleansing, unsupervised training, or classification, and

the model being created using at least one of:

a logistic regression, a Naïve Bayesian classifier, or a support vector machine (SVM) classifier;

determining, by the device using the model that is associated with the service and based on the current demand associated with the service, a predicted future demand for the service during a time period;

determining, by the device, a current capacity to provide the service based on real-time service provider information associated with service providers that are providing the service in the region;

determining, by the device, whether the predicted future demand for the service exceeds the current capacity to provide the service or whether the current capacity to provide the service exceeds the predicted future demand for the service; and

causing, by the device, one or more machines to relocate to a particular location of the region to facilitate providing the service during the time period when the predicted future demand for the service exceeds the current capacity to provide the service.

2. The method of claim 1, further comprising:

obtaining real-time usage data associated with the service providers that are providing the service in the region; obtaining environment data associated with the region,

the environment data indicating one or more environmental factors that affect the service in the region; and

determining the current demand based on the real-time usage data and the environment data.

3. The method of claim 1, wherein the one or more machines include at least one of:

an autonomous vehicle, an unmanned aerial vehicle, a portable kiosk, or a transaction terminal.

4. The method of claim 1, further comprising:

receiving historical information associated with the service provided in a region larger than the region associated with the service, and

determining the predicted future demand based upon the historical information.

5. The method of claim 1, further comprising:

determining that the predicted future demand for the service exceeds the current capacity to provide the service;

identifying one or more additional service providers that are available to provide the service in the region; and transmitting a notification to the one or more additional service providers to be available to provide the service in the region.

6. The method of claim 5, wherein the historical information associated with providing the service is associated with a region that is larger than the region associated with the service.

7. The method of claim 1, further comprising:

using a machine learning model to determine the current demand,

the machine learning model including a natural language processing model to identify key terms, words, or phrases associated with the service.

8. A device, comprising:

one or more memories; and

one or more processors, communicatively coupled to the one or more memories, to:

determine a current demand associated with a service that is provided within a region;

identify a model that is associated with the service,

the model being trained based on:

consumer profile data relating to consumers that have received the service in the region,

service provider data associated with service providers that have provided the service in the region, and

historical information associated with the service providers providing the service in the region,

the model being trained using machine learning including at least one of:

data cleansing, unsupervised training, or classification, and

the model being created using at least one of:

a logistic regression, a Naïve Bayesian classifier, or a support vector machine (SVM) classifier;

determine, using the model that is associated with the service and based on the current demand associated with the service, a predicted future demand for the service during a time period;

obtain real-time usage data associated with service providers that are providing the service in the region to determine a current capacity;



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determine whether the predicted future demand for the service exceeds the current capacity to provide the service or whether the current capacity to provide the service exceeds the predicted future demand for the service; and

cause one or more machines to relocate to a particular location of the region to facilitate providing the service during the time period when the predicted future demand for the service exceeds the current capacity to provide the service.

9. The device of claim 8, wherein the one or more processors, when predicting the predicted future demand, are to:

predict the predicted future demand based on a prediction model,

the prediction model including at least one of:

a linear regression model,

a logistic regression model,

a decision tree model,

a random forest model,

a gradient boosting model, or

a neural network model.

10. The device of claim 8, wherein the one or more machines include at least one of:

an autonomous vehicle,

an unmanned aerial vehicle,

a portable kiosk, or

a transaction terminal.

11. The device of claim 8, wherein the one or more processors, when causing the one or more machines to relocate to the particular location of the region, are to:

cause the one or more machines to relocate to the particular location of the region using at least one of:

an address, or

navigational instructions.

12. The device of claim 8, wherein the one or more processors are further to:

determine that the predicted future demand for the service exceeds the current capacity to provide the service;

identify one or more additional service providers that are within a particular range of the region and are unqualified to provide the service; and

transmit qualification information to the one or more additional service providers to enable the one or more additional service providers to be qualified and available to provide the service during the time period.

13. The device of claim 8, wherein the one or more processors are further to:

identify one or more potential additional service providers that may provide the service; and

provide qualification information to the one or more potential additional service providers.

14. The device of claim 13, wherein the one or more processors are further to:

obtain the qualification information from a website or a certification database, the qualification information including at least one of:

information identifying a needed certification, or

information associated with a class to become certified.

15. A non-transitory computer-readable medium storing instructions, the instructions comprising:

one or more instructions that, when executed by one or more processors, cause the one or more processors to:

determine a current demand associated with a service that is provided within a region, the current demand

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being based on real-time usage data associated with service providers that are currently providing the service in the region;

identify a model that is associated with the service, the model being trained based on:

consumer profile data relating to consumers that have received the service in the region,

service provider data associated with service providers that have provided the service in the region, and

historical information associated with the service providers providing the service in the region,

the model being trained using machine learning including at least one of:

data cleansing,

unsupervised training, or

classification, and

the model being created using at least one of:

a logistic regression,

a Naïve Bayesian classifier, or

a support vector machine (SVM) classifier;

determine, using the model that is associated with the service and based on the current demand associated with the service, a predicted future demand for the service during a time period;

determine a current capacity to provide the service based on real-time service provider information associated with service providers that are providing the service in the region;

determine whether the predicted future demand for the service exceeds the current capacity to provide the service or whether the current capacity to provide the service exceeds the predicted future demand for the service; and

cause one or more machines to relocate to a particular location of the region to facilitate providing the service during the time period when the predicted future demand for the service exceeds the current capacity to provide the service.

16. The non-transitory computer-readable medium of claim 15, wherein the one or more instructions, when executed by the one or more processors, further cause the one or more processors to:

obtain environment data associated with the region, the environment data indicating one or more environmental factors that affect the service in the region; and

determine the current demand based on the real-time usage data and the environment data.

17. The non-transitory computer-readable medium of claim 15, wherein the one or more machines include at least one of:

an autonomous vehicle,

an unmanned aerial vehicle,

a portable kiosk, or

a transaction terminal.

18. The non-transitory computer-readable medium of claim 15, wherein the one or more instructions, when executed by the one or more processors, further cause the one or more processors to:

train the model to identify trends that indicate past demand for the service using consumer profile data, service provider data, and historical information; and

wherein, when predicting the predicted future demand, the one or more processors are to:

predict the predicted future demand based on the trends that indicate the past demand for the service.

19. The non-transitory computer-readable medium of claim 15, wherein the one or more instructions, when executed by the one or more processors, further cause the one or more processors to:

- obtain real-time usage data associated with service providers that are providing the service in the region; 5
- obtain environment data associated with the region, the environment data indicating one or more environmental factors that affect the service in the region; and 10
- determine the current demand based on the real-time usage data and the environment data.

20. The non-transitory computer-readable medium of claim 15, wherein the one or more instructions, when executed by the one or more processors, further cause the one or more processors to: 15

- identify one or more additional service providers that are available to provide the service in the region; and
- send a notification to the one or more additional service providers to be available to provide the service in the region. 20

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